SECTION 708
EROSION CONTROL

708.01 DESCRIPTION.

This work consists of furnishing and installing erosion control measures which include seeding, placing sod, mulch cover, soil retention blankets, riprap, formed fabric, concrete slope protection and other measures as specified.

708.02 SEEDING, SODDING, AND MULCHING.

A. **Description.** This work consists of laying sod, seeding, and if specified, placing a mulch cover.

B. **Materials.**

1. **Seeding.**

a. **General.** The seed furnished shall be the species and varieties specified and shall meet or exceed Pure Live Seed requirements. Seed and seeding mixture shall be free of all prohibited noxious weed seed and shall not contain more than 1/2 of 1% by weight of restricted noxious weed seeds. Prohibited and restricted noxious weeds shall be those as classified by the North Dakota State Seed Department.

Seed which has become wet, moldy, or damaged in transit or in storage will not be accepted.

b. **Seed Testing.** All seed shall be tested within 9 months before the planting date. The Contractor shall have the testing performed by a State Seed Lab, Commercial Seed Testing Lab, or a registered member of the Society of Commercial Seed Analysts. A certified test report shall be furnished to the Department before the seeding operation starts. Seed not planted within the 9-month period shall be retested for dormant seed, hard seed, and germination, and a new certified test report furnished.

c. **Labeling.** Each bag of seed delivered to the Project shall bear a tag which shows the following information:

(1) Name and address of supplier

(2) Supplier’s lot number for each kind of seed in the mixture

(3) Origin (where grown) for each kind of seed

(4) Purity and germination for each kind of seed

(5) Date of latest test

(6) Pounds of bulk seed of each kind of seed in each bag

(7) Total pounds of bulk seed mixture in each bag

(8) Pounds of pure live seed of each kind of seed in each bag

(9) Total pounds of pure live seed mixture in each bag

d. **Seed Classes.** The class of seed and the minimum amount of seed per acre shall be as follows:

Grass Species	**Variety**	**Pounds Pure Live Seed Per Acre**
Class I		
Western Blue Grass	Park	40
Perennial Rye Grass	--	10
Class II		
Western Wheatgrass	Rodann or Rosanna	6
Switchgrass	ND-965-98, Nebraska 28, or Sunburst	3
Green Needlegrass	Lodorm	4
Sideoats Grama*	Killdeer or Pierre	4
Slender Wheatgrass	Revenue or Primar	1
		18
Class III (Hydro-Mulch		
Western Wheatgrass	Rodan or Rosanna	9
Switchgrass	ND-965-98, Nebraska 28, or Sunburst	4
Green Needlegrass	Lodorm	6
Sideoats Grama*	Killdeer or Pierre	6
Slender Wheatgrass	Revenue or Primar	2
		27

Seed for Hydro-Mulch in urban areas shall be Class V.

Class IV (Temporary Cover Crop)		
Oats		10
Class V (As specified on the Plans)		
Class VI		
Oats		15

*If Sideoats Grama is unavailable, Thickspike Wheatgrass of the Critana or Elbee variety may be substituted.

Seed for the reseeding of small areas damaged during construction or maintenance operations shall be as specified on the Plans.

e. **Fertilizer Requirements.**

(1) **Class I, II, and V.** A fertilizer mixture shall be applied that furnishes a minimum of 20 pounds of Nitrogen (N) and 20 lbs. of Phophorous (P_2O_5) per acre.

(2) **Class III.** The fertilizer to be used when Hydro-Mulch seeding is specified shall be a mixture of 20-20-0 and urea formaldehyde (36-0-0). It shall be uniform and delivered in bags or other containers, labeled according to state law and bearing the name, trademark or trade name, and warranty of the producer. The 20-20-0 shall be applied at a rate assuring 20 pounds of actual Nitrogen (N) and 20 pounds of actual phosphorus (P_2O_5) per acre. The urea formaldehyde shall be applied at a rate of 60 pounds per acre assuring 20 pounds of actual Nitrogen (N) per acre.

The required fertilizer shall be incorporated in the hydro-mulch slurry and applied with the seed at the specified rate.

2. **Sodding.**

a. **General.** Sod shall consist of dense well-rooted growth of permanent and desirable grass, native or adapted to the general locality where it is to be placed, such as Kentucky Blue Grass. The sod shall be free from weeds or undesirable grasses. When the sod is cut, the grass shall be no longer than 2 inches.

The sod shall be uniform in thickness, and shall not tear or break when being handled or placed.

b. **Peat Sod.** Peat sod will not be allowed. Peat sod is defined as that which contains more than 20% organic material as determined by test method AASHTO T-267.

c. **Sampling, Testing, and Certification.** The Contractor shall submit to the Project Engineer a “Certificate of Compliance” from a recognized independent testing laboratory stating that the soil upon which the furnished sod was grown does not contain more than 20% organic matter. The percentage of organic matter shall be determined according to the latest version of AASHTO test method T-267. The certification, or a copy, shall accompany each shipment of sod to the project.

The testing laboratory shall obtain and test two samples (at least 50 feet apart) from each 2.5 acre tract (hectare), or fraction thereof, in the sod field.

Certifications will be in effect for 5 years, at which time the sod field must be recertified.

If the sod placed on the project comes from more than one location, each location will require certification.

The Certificate of Compliance shall include:

(1) Project number.

(2) Name of Contractor and Subcontractor.

(3) Location and size of sod field.

(4) Sampling and testing dates.

(5) Number of samples and tests.

(6) Statement that the sod covered by this certification was grown in the area tested, and meets the 20% organic material limitation as determined by AASHTO T-267.

(7) Name of independent testing laboratory.

(8) Signature of a person who has the legal authority to bind the testing laboratory.

The cost of sampling and testing will not be paid for separately, but shall be included in the price bid for "Sodding."

The Department reserves the right to sample and test the sod and the sod field at any time.

3. **Mulching.**

a. **Hydro Mulching.** Mulch to be used when the Class III (Hydro Mulch) seeding method is specified shall consist of a wood cellulose fiber that has not been treated with any germination or growth inhibitive substances. The mulch shall be treated with a tackifier to enhance seed and mulch placement and adherence to the soil. The mulch shall be free of contamination from noxious weed seed and seed from competitive plants.

b. **Straw Mulching.** Material for straw mulching shall consist of native hay or the straw from oats or barley, and shall be seed free to prevent introduction of weeds as defined by the rules and regulations of the North Dakota Department of Agriculture. At least 50% of the mulch by weight shall be 10 inches or more in length. Dry mulching material which breaks and does not bend is unacceptable.

c. **SS-1 Emulsion.** SS-1 Emulsion shall meet Section 818.

C. **Construction Requirements.**

1. **Seeding.**

a. **General.** Areas to be seeded shall be cleared of all material that is detrimental to seedbed preparation. The cleared areas shall be shaped to the Plan cross section, or to the cross section that best fits existing conditions.

(1) No seed shall be sown when the wind velocity exceeds 15 miles per hour.

(2) No seed shall be sown in standing water or frozen ground.

(3) All slopes shall be worked on the contour, or as directed by the Engineer.

(4) Ten pounds of oats per acre shall be seeded at the time of, or immediately preceding the seeding of Class I, II, and V grass mixtures. This is in addition to the oats (Class IV) seeded during the summer months while the seeding of other classes was prohibited. See seasonal limitations Section 708.02 C.1.d.

b. **Topsoil.** Topsoil shall consist of loose, friable, loamy topsoil free of excess acid, alkali, and objectionable amounts of sod. Topsoil shall have demonstrated the growth of healthy crops or grasses.

c. **Types of Seedbed Preparation.**

(1) **General.** The seedbed shall be disked or field cultivated to a depth of approximately 3 inches. A harrow or cultipack (roller) shall be used so that the bed is firm and the seed can be placed at the proper depth (1/2 to 3/4 inch).

The seedbed shall be smooth and firm, and all lumps or clods exposed by the initial pass of tillage equipment shall be broken up to one inch in diameter or less. The seedbed on sites that are to be hydroseeded shall be left in a loose condition.

The type of seedbed preparation shall be as specified.

(2) **Type A.** This type of seeding shall be specified when stripping and stockpiling topsoil is not required.

The areas of exposed backslopes shall be covered as far as possible with the existing topsoil available during finish grading work without loading and transporting the topsoil.

When a grading project requires “rounding” of the top of the backslopes, as much as possible of the “rounding” excavation shall be preserved to be spread over the exposed backslope in the final finishing operations before seeding.

(3) **Type B.** This type of seeding involves the use of the topsoil salvaged and replaced during grading operations.

(4) **Type C.** This seeding type requires placing approved topsoil from borrow areas to form a seedbed. The Contractor shall furnish the borrow areas if they are not shown on the Plans. Before topsoil is placed, the surfaces shall be shaped to the required section and disked, harrowed, scarified, or plowed to a depth of approximately 2 inches. The topsoil shall be placed in a uniform thickness to the depth shown on the Plans.

Topsoil borrow areas shall be finished according to Section 203.

d. **Seasonal Limitations.** Class I, II, III, and V seed mixtures shall be sown before June 15 and after September 1. Class IV (Temporary Cover Crop) shall be seeded during the time period from June 15 to August 10 on any areas prepared for seed and in need of erosion protection. The specified class of seed shall be planted into the cover residue after September 1.

e. **Seeding Equipment Requirements.**

(1) **Classes I, II, and V.** The specified seed or seed mixture shall be drilled in uniformly using a grass drill equipped with individually mounted adjustable spring loaded, double disk furrow openers fitted with depth bands and packer wheels. The drill furrow spacing shall not exceed 8 inches.

The depth control bands shall be of a size to provide final planting depth of 1/2 to 3/4 inch.

Packer wheels shall have adjustable spring tension and be mounted individually on each furrow opener or be mounted independently with a press wheel situated to follow directly behind each opener.

The seed box shall be equipped with a positive feed mechanism which accurately meters free flowing introduced (tame) grasses in a uniform manner and shall have agitators which prevent seed bridging. If chaffy native grasses (Sideoats Grama, Big Bluestem, Indian grass) are part of the specified seed mixture, the seed box shall be equipped with a positive feed picker-wheel mechanism with oversize teeth and augur style agitators which accurately meters the chaffy native grasses either in a mixture or separately in a uniform manner. The seed box shall have baffles or partitions that keep all seeds uniformly mixed during drilling.

(2) **Class III.** Equipment to be used when Class III (Hydro-Mulch) seeding is required shall be hydraulic equipment capable of uniformly mixing the specified seed in water for uniform distribution. The mulch may be applied simultaneously with the seed and fertilizer, or within 24 hours after application of seed and fertilizer.

(3) **Class IV.** The equipment required to seed Class IV seed shall be a press drill equipped with an agitation system or other system that provides a uniform flow of seed at the required rate.

(4) **Other Equipment.** Power sprayers, blowers, hydraulic applicators, or broadcasters may be used on slopes steeper than 3:1 or areas too small to be seeded with a drill. The seeding rate shall be at least 120% of the normal rate, and the seed shall be covered by operating a drag harrow and a light packer over the seeded area. All equipment shall be approved by the Engineer before it is used.

Areas will be visually inspected for uniformity of application. Areas which do not reveal adequate and uniform coverage shall be reseeded at the Contractor’s expense.

f. **Fertilizer.** Fertilizer may be applied before seeding by mechanical spreaders, blowers, or hydraulic equipment provided the fertilizer is worked into the soil to a depth of from one to 3 inches. Fertilizer shall not be applied after seeding. The fertilizer shall not be mixed with the seed, but it may be applied at the same time as the seed if a suitable fertilizer attachment on the drill is used. The fertilizer may be mixed into the Class III (Hydro-Mulch) mixture as it is applied.

g. **Reseeding and Repair.** Damage from wind or the Contractor's operation shall be repaired at the Contractor's expense. Repairs shall be made before final acceptance.

h. **Temporary Care.** Areas seeded by the Hydro-Mulch method shall be wetted by daily sprinkling for the first 5 days, and then periodically for the next 10 days to keep the soil moist for a depth of 3 inches.

2. **Sodding.**

a. **Preparation of the Earth Bed.** The area to be sodded shall be shaped to the required cross section and contour, and shall be free of stones larger than 2 inches in diameter and other debris which interfere with the proper laying and growth of the sod.

b. **Placing the Sod.** The sod on slopes shall be laid in horizontal strips beginning at the bottom of the slope and working upwards. In ditches the long length of the strip shall be placed at right angles to the flow.

Sod shall be laid so the joints formed by the abutting ends of strips are not continuous. Each strip shall be laid snugly against the strip previously laid. The ends of strips shall be placed to produce a broken line at the edges.

The outside edges of sodded areas (top, bottom, and sides) shall be turned into the soil and a layer of earth placed over the juncture. This earth shall be thoroughly compacted.

c. **Staking the Sod.** On slopes 4:1 or steeper, the sod shall be anchored with stakes at least 6 inches in length spaced from 18 inches to 36 inches apart along the longitudinal axis of the sod strip. Stakes shall be driven within 1" of the sod surface.

d. **Clean-Up.** After sod placement is complete, the surface shall be cleared of loose sod, excess soil, or other foreign material.

e. **Fertilizer.** When fertilizer is specified, its analysis and application rate will be shown on the Plans.

f. **Care and Maintenance.** The maintenance period of the sod will be 4 weeks from the time the sod placement is completed.

The Contractor shall be responsible for the watering and maintenance of the sod; and shall furnish and replace, without compensation, any sod that contains excess organic material, dies, is damaged, or washes out

during the maintenance period. Replacement sod shall be installed under the same Specification requirements as those for the original sod, including the maintenance period.

The time between October 15 of any year and April 15 of the following year will not be a part of the required maintenance period. Sod placed at a time when the maintenance period extends past October 15 will not be accepted until it shows evidence of established growth after April 15 of the following year.

g. **Acceptance.** At the end of the 4-week maintenance period, the sod that is firmly established, well-rooted, growing, and green, will be accepted by the Engineer. Unacceptable sod shall be replaced as specified in Section 708.02 C.2.f, above.

3. **Hydro-Mulch.** The mulch shall be uniformly applied at a rate of one ton per acre and shall cover a minimum of 95% of the seedbed area. After application, the mulch shall permit percolation of water to the underlying soil.

4. **Straw or Hay Mulching.**

a. **General.** The mulch shall be placed within 24 hours after the seeding has been completed.

Mulching operations shall not be performed during periods of excessively high winds which would preclude the proper placing of the mulch.

Mulch containing excessive moisture which prevents uniform feeding through the machine shall not be used. Bales shall be broken up and loosened as they are fed into the blower to avoid placement of matted or unbroken lumps.

b. **Equipment.** The mulch shall be machine blown and shall be uniformly distributed over the seeded areas. The machine shall be of a design that minimizes cutting or breaking of the mulching material.

c. **Application.** The mulch shall be placed uniformly over the seeded areas at the rate of 2 tons per acre. Approximately 10% of the soil surface shall be visible through the mulch blanket before the mulch tiller (punching) operation.

Excessive cover which smothers seedlings of small seeded grasses shall be avoided.

d. **Anchoring.** If not specified, one of the following 2 methods shall be used at the Contractor's option:

(1) **Punching.** Immediately following application, mulch shall be punched into the soil using a mulch tiller consisting of a series of dull, flat disks with notched or cutout edges. The disks shall be approximately 20 inches in diameter, 1/4 inch thick, spaced approximately 8 inches apart, and shall be fitted with scrapers.

The tiller shall be operated on contour, except on slopes steeper than 3:1 where diagonal operations are required using a tractor with dual

drive wheels or crawler treads on the tractor to minimize side slip and rutting to slopes.

Tiller members shall be ballasted as necessary to push the mulch into the soil 3 inches with ends of the mulch exposed above the soil surface.

(2) **Asphalt.** An emulsion shall be applied by spraying simultaneously with the mulch or by spraying a surface application immediately following mulching. The application rate of the emulsion shall be between 225 and 275 gallons per acre. All traffic, signs, structures, and other objects shall be protected from being marked or splattered by the material.

e. **Temporary Maintenance.** Repairs shall be made as necessary before final acceptance as directed by the Engineer.

All areas that have been properly anchored and accepted by the Engineer that have to be remulched because of wind or water erosion shall be at the Department's expense. All areas damaged by traffic or the construction operations shall be repaired at the Contractor's expense.

D. **Method of Measurement.**

1. **Seeding.** Seeding or any authorized reseeding on seedbed preparation will be measured by the Acre or Mile along the roadway centerline, complete and in place.

2. **Temporary Cover Crop.** Hydro-Mulch and Temporary Cover Crop seeding will be measured by the Acre complete and in place.

3. **Topsoil for Type B Seedbed.** Topsoil for Type B seedbed preparation will not be measured for payment as part of seeding operations, but will be measured and paid for as part of grading operations according to Section 203.

4. **Topsoil for Type C Seedbed.** Topsoil for Type C seedbed preparation will be measured by the cubic yard in its original position in the borrow area or in the hauling unit.

5. **Fertilizer.** Fertilizer will be measured by the Hundred Weight (CWT), used as authorized and required. No measurement will be made when fertilizer is not a pay item and no payment will be made.

6. **Sodding.** Sod will be measured by the Square Yard, complete, in place, and accepted by the Engineer. Water will not be measured for payment but will be incidental to the item Sodding.

7. **Mulching.** Mulching or any authorized remulching will be measured by the Acre complete and in place. Anchoring of the mulch shall be incidental to the mulching bid item.

E. **Basis of Payment.**

Should the quantity of seeding, sodding, or mulching which is part of an approved subcontract decrease by more than 25%, the Contractor may submit a request for

an adjustment of the Contract Unit Price. The adjustment in unit price will only be considered if it justifies an increase in the pro rata share of the fixed costs chargeable to the item because of the decreased quantity. The total payment for the final quantity shall not exceed 75% of the original contract quantity at the Contract Unit Price.

Should the quantity of seeding, sodding, or mulching which is part of an approved subcontract increase by more than 25% from the original contract quantity either party to the contract may submit a request for an adjustment of the Contract Unit Price for the quantity in excess of 125% of the original contract quantity.

The Contractor shall provide a notice of intent to request an adjustment in the Contract Unit Price as soon as the Contractor is aware of overruns or underruns. All adjustments in unit price will be determined according to Section 104.03 B.2. if requested by the Department, the Contractor shall furnish the bid documents used to calculate the Contract Unit Price. Failure to submit the bid documents will result in the Contractor waiving all rights to an adjustment in the Contract Unit Price.

Payment will be made at the Contract Unit Prices for the following:

Pay Item	**Pay Unit**
Seeding: Type ___ Class ___	Acre or Mile
Temporary Cover Crop	Acre
Topsoil for Type C Seeding	Cubic Yard
Fertilizer	CWT
Sodding	Square Yard
Mulching	Acre

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

708.03 SOIL RETENTION BLANKET.

A. **Description.** This work consists of placing a soil retention blanket on a prepared slope or channel.

B. **Materials.**

Material shall meet the following:

Item	**Section**
Wood Excelsior Fiber Mat	856.01
Straw and Fiber Mats	856.02
Erosion Control Fabric	856.03
Staples	856.04
Fiberglass Roving	856.05
Bitumen for Fiberglass Roving	818

C. **Construction Requirements.**

1. **Wood Excelsior, Straw, or Fiber Mat.** The area to be covered shall be properly prepared and seeded before the blanket is applied. All rocks or clods

over 1-1/2 inches in diameter, and all sticks and other foreign material shall be removed.

If netting is specified for one side only, the blanket shall be placed with the netting on top and the fibers in contact with the soil.

In ditches, blankets shall be unrolled in the direction of water flow, butted snugly against each other, and stapled every 5 feet at joints and edges.

On slopes, blankets may be unrolled either horizontally or vertically to the slope. Ends and sides shall be butted snugly and stapled.

2. **Erosion Control Fabric.** Installation shall be per manufacturer's recommendation.

3. **Repair of Soil Retention Blanket.** Soil retention blanket damaged by construction operations shall be repaired by and at the Contractor's expense. The area shall be restored to the proper contour, seeded and fertilized, and recovered with the same type of soil retention blanket that was damaged.

D. **Method of Measurement.**

1. **Wood Excelsior, Straw, and Fiber Mat.** Wood Excelsior or Fiber Mats shall be measured by the actual surface area covered to the nearest square yard. Staples or any other material required to place the material as specified will not be measured for payment, but will be considered incidental to Wood Excelsior Fiber Mat. Material not properly placed, damaged, or wasted, will not be measured for payment.

2. **Erosion Control Fabric.** Erosion Control Fabric will be measured by the actual surface area covered to the nearest square yard. No allowance will be made for overlaps, anchor trenches, or check slots. Staples or other material required to install the material as specified will be considered incidental to Erosion Control Fabric. Material not properly placed, damaged, or wasted will not be measured for payment.

E. **Basis of Payment.**

Payment will be made at Contract Unit Prices for the following:

Pay Item	**Pay Unit**
Wood Excelsior Mat	Square Yard
Straw Mat	Square Yard
Straw-Fiber Mat	Square Yard
Fiber Mat	Square Yard
Erosion Control Fabric	Square Yard
Fabric Formed Slope Protection	Square Yard

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

708.04 RIPRAP AND AGGREGATE CUSHION.

A. **Description.** This work consists of furnishing or salvaging, and placing stone or broken concrete on slopes, channelways, or other areas.

B. **Materials.**

1. **Wire Mesh.** Wire Mesh shall meet Section 836.03 C.

2. **Grout.** Grout shall be composed of one part Portland Cement and 2 parts sand by volume. All materials shall be approved before being used.

3. **Riprap.** Riprap shall consist of sound, durable field stone, quarry stone or broken concrete.

   a. **Gradation.**

   Riprap shall meet the following gradations:

Size (Inches)	Percent Smaller
28*	80-100
22*	30-80
16	20-50
10	0-5

*The maximum size of stone permitted for riprap installation shall not exceed the specified thickness of the riprap blanket by more than 6 inches. Stone of this excess size may be placed providing it does not exceed 10% of the total stone and can be blended satisfactorily into the riprap.

   b. **Field Stone.** Acceptable field stone shall be any field stone not made of sandstone, shale, or soft limestone; or not easily abraded or crushed. The stone shall not contain cracks or flaws that would cause splitting or breakup during loading, hauling, and placing.

   c. **Quarry Stone.** Quarry stone shall be obtained from an undisturbed deposit of rock that, if properly processed, would meet the requirements of concrete coarse aggregate for soundness and abrasion. Local deposits of sandstones or limestones and similar stone of sedimentary origin shall not be used as riprap stone.

4. **Aggregate Cushion.** Aggregate Cushion shall meet the requirements of Section 816 for Class 8.

C. **Construction Requirements.**

1. **General.** The slope shall be excavated, shaped, and completed to the required cross section and elevation.

   The laying of stone on sloped areas shall begin at the toe of the slope, and a trench shall be dug to the dimensions specified. When no dimensions are shown, a trench at least one foot deep shall be dug, and the largest stones shall be placed in the trench. The riprap shall be thoroughly compacted as the construction progresses and the finished surface of the riprap shall present an even, tight surface. Gaps shall be filled with smaller stones.

2. **Aggregate Cushion.** Aggregate cushion shall be spread over the specified area before placing the riprap.

3. **Wire Mesh Riprap.** When wire mesh riprap is specified, the riprap stone shall have wire mesh above and below the layer of rock and around the ends and sides.

Strips of wire mesh shall be laid parallel to the length or direction of the riprap. Adjoining strips and ends of strips shall be tied every 18” with wire at all abutting wire sections.

End splices of a strip of wire mesh shall be staggered at least 10 feet with the end splices in the adjacent strip of wire mesh. No length of wire mesh less than 10 feet long shall be used.

The lower layer of wire mesh shall be tied to the upper layer of mesh with wire ties spaced not over 2 feet center to center each way.

4. **Loose Rock Riprap.** When loose rock riprap is specified, the rock may be placed by mechanical means or by hand. Damage to the prepared slope or to structural components shall be repaired at the Contractor’s expense.

   Riprap stone shall be distributed evenly over the riprap area without pockets of segregated sizes of stone. The stone may have to be rearranged by manual or mechanical means if placement methods result in pockets of segregated size of stone.

   The finished surface of the riprap area shall present an even distribution of stone sizes over the entire riprap area with no one area of any size deviating from the Plan slope and grade by 6 inches.

D. **Method of Measurement.**

1. **Wire Mesh Riprap.** Wire Mesh Riprap will be measured by the Square Yard in place. The area will be computed on the basis of actual surface dimensions as staked and the specified thickness.

2. **Loose Rock Riprap.** Loose Rock Riprap will be measured in the hauling vehicle by either the Cubic Yard or by the Ton.

   Loose Rock Riprap not placed as specified and not accepted by the Engineer will be deducted from the total material measured and will not be paid for.

   The Engineer will deduct for any partial load delivered or any load containing contaminants. The deduction will be solely based upon the judgment of the Engineer.

   Stone exceeding the maximum allowable size by more than 10% in any dimension will be rejected and not measured for payment. The Contractor shall dispose of such oversize stone.

   Aggregate Cushion will be measured by the Ton or Cubic Yard as shown on the Plans. The volume will be computed on the basis of actual surface dimensions as staked and the specified thickness.

E. **Basis of Payment.**

Payment will be made at Contract Unit Prices for the following:

Pay Item	**Pay Unit**
Wire Mesh Riprap	Square Yard
Loose Rock Riprap	Ton or Cubic Yard
Aggregate Cushion	Ton or Cubic Yard

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

708.05 FABRIC FORMED SLOPE PROTECTION.

A. **Description.** This work shall consist of furnishing and placing an approved grout-injected fabric-formed slope protection.

B. **Materials.**

Material shall meet the following:

Item	Section
Cement	804.01
Fly Ash	820
Water	812
Concrete Admixtures	808
Aggregate	816
Fabric	856.06

Aggregate grading shall be consistent and shall be well graded from the maximum size which can be conveniently handled with available pumping equipment.

Grout shall consist of a mixture of Portland Cement, fine aggregate, and water proportioned to provide a pumpable slurry. The mix shall obtain a compressive strength of 2,500 psi at 28 days. The air content of the mixed grout shall be in the range of 5% to 8%.

C. **Construction Requirements.** Only approved mixing and pumping equipment shall be used in preparation and handling of grout. Oil or other rust inhibitors shall be removed from mixing drums, stirring mechanisms, and other portions of equipment in contact with grout before the mixers are used. Pumping equipment shall have a variable flow rate to provide enough pressure for pumping without breaking the fabric.

All material shall be accurately measured by volume or weight as it is fed into the mixer. The quantity of water shall produce a grout having a pumpable consistency. Mixing time shall be at least one minute. If agitated continuously, the grout may be held in the mixer or agitator for 2-1/2 hours or less in temperatures below 70ºF, and for 2 hours or less at higher temperatures. If a lapse in pumping operation occurs, the grout shall be recirculated through the pump, or the mixer drum, or the agitator and pump.

Before grout injection, the fabric must be positioned at its design location. Each panel shall be continuous or monolithic for its full width, and all seams must be vertical. Grout shall be introduced into the space between the layers of fabric and shall be injected to avoid excessive pressure on the fabric envelope. Adjacent fabric panels shall be joined before grout injection by field sewing with nylon thread. Where adjacent panels cannot be joined in this manner, or where specified, adjacent panels shall be lapped a minimum of 2 feet. In no case will simple butt joints be permitted.

In the event that blisters or blowouts occur during grout injection, the section affected shall be repaired or replaced to match adjacent surfaces.

Sequence of injected grout must follow the manufacturer's recommendations.

The fabric-forming material shall not be placed or filled on frozen ground. The injected grout shall be protected from freezing for at least 4 days after placement. No curing of the completed mat will be required.

D. **Method of Measurement.** Fabric-Formed Slope Protection, including embedded portions, will be measured in Square Yard, complete and in place, based on the dimensions shown on the Plans.

E. **Basis of Payment.**

Payment will be made at the Contract Unit Price for the following:

Pay Item	**Pay Unit**
Fabric-Formed Slope Protection	Square Yard

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

708.06 CONCRETE SLOPE PROTECTION.

A. **Description.** This work consists of placing a cast-in-place concrete slope protection.

B. **Materials.**

Materials shall meet the following:

Item	**Section**
Cement	804.01
Fly Ash	820
Aggregate	816
Water	812
Air-Entraining Admixture	808
Curing Materials	810
Welded Steel Wire Fabric	836.03 C
Reinforcing Steel	836
Preformed Expansion Joint Filler	826.02
Joint Sealer	826.02 A.4

C. **Construction Requirements.**

1. **Preparation of Subgrade.** The subgrade, for placing concrete slope protection, shall be free of rubbish and vegetation. All loose material shall be thoroughly compacted. The Contractor shall excavate or backfill as required to obtain the Plan cross section or lines and grades established in the field.

   All dry surfaces shall be wetted before placement of concrete. Concrete shall not be placed on any surface which is spongy or where free water exists.

   The areas adjacent to the slope protection shall be left in a smooth, uniform condition.

2. **Placing Reinforcement.** The reinforcement shall be free from dirt, detrimental scale, paint, oil, or other foreign substance.

   Welded steel wire fabric and bar reinforcement shall be placed and secured so its final position in the hardened concrete meets the specified requirements.

3. **Composition of Concrete.** Concrete shall be Class AE-3 and shall meet Section 802.

4. **Placing Concrete.** Weather limitations shall be as specified in Section 602.

   The concrete shall be placed and consolidated by methods that prevent segregation or sagging.

   Whenever placement of concrete is stopped for the day or otherwise interrupted for more than 30 minutes, a construction joint shall be placed at the end of a panel.

5. **Relief Joints.** Joints shall consist of perpendicular grooves in the surface of the plastic concrete. The grooves shall meet the dimensions and locations shown on the Plans. They shall be maintained to the required shape during any subsequent finishing operations until the concrete has hardened.

   The joints may be sealed as soon as the concrete becomes stiff enough to prevent distortion to the groove or damage to the concrete. The grooves shall be cleaned and devoid of foreign substance or free water when the joint sealer is applied. The sealer shall be applied with a caulking gun or other approved device.

6. **Finishing Concrete.** The final finish shall be obtained with a wood float. The surface shall be checked for irregularities with a 10-foot straightedge. The allowable tolerance for depressions or high spots in any 10 feet shall be 3/4 inch.

7. **Curing Concrete.** After final finishing, the concrete shall be cured according to Section 550.04, except that the minimum curing period shall be 5 days.

8. **Tests on Concrete.** The concrete will be tested according to Section 802.

D. **Method of Measurement.** Concrete Slope Protection will be measured parallel to the surface by the Square Yard, complete and in place, based on the dimensions shown on the Plans.

   The cost of all earthwork shall be incidental to the bid item Slope Protection.

E. **Basis of Payment.**

   Payment will be made at the Contract Unit Price for the following:

Pay Item	**Pay Unit**
Concrete Slope Protection	Square Yard

   This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.